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Plume-Chimney in Natural Convection from Large Sources.[1] CHRISTOPHER CHU[2], Universiti Malaysia Sabah — A natural draft chimney is defined by the existence of buoyancy and a solid wall barrier between two regions of fluids that differ in density. By preventing the mixing of two fluids at different densities in a fluid environment, there is effectively a wall-like characteristic, a chimney system without the solid walls. An "effective plume height" was pioneered by heat transfer engineers to close the solution loop of the natural convection performance of forced draft air-cooled heat exchangers, by modifying an atmospheric plume rise model. An improved prediction method was later developed and satisfactorily validated by both experiments and computational fluid dynamics (CFD) simulation of the natural convection performance of an industrial-scale air-cooled heat exchanger. The flow development region that has been identified in the field of jets is known as the zone of flow establishment (ZFE), but in lazy plumes of low Froude number it has stack effect. Two reasons for justifying the concept of plume-chimney are: 1) it affects the draft of a natural convection system of large source area by extending the solid-walled chimney height and 2) its existence anticipates a potential blockage to cross current such as wind in real natural convection systems, modifying the flow pattern.

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